MNE2110: ENGINEERING MATERIALS

Effective Term
Semester B 2023/24

Part I Course Overview

Course Title
Engineering Materials

Subject Code
MNE - Mechanical Engineering
Course Number
2110

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
AP1201/PHY1201 General Physics I or
BCH1100 Chemistry or CHEM1300 Principles of General Chemistry or
PHY1101 Introductory Classical Mechanics

Precursors
HKDSE Physics or Design and Applied Technology or equivalent

Equivalent Courses
MBE2110 Engineering Materials

Exclusive Courses
MBE2034/MNE2034 Engineering Materials and Processing

Additional Information
#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

The aims of this course are to equip students with:

- basic knowledge of the structure and properties of engineering materials, both metallic and non-metallic types, used in engineering applications including those in aerospace industries;
- an ability to identify the microstructure-property (especially mechanical properties) relationships and to select appropriate materials for mechanical components/products;
- an ability to describe and select appropriate manufacturing processes with given materials for target structures and products.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic structure and behaviour of typical engineering materials.		x	x	
2	Apply basic knowledge of materials to select suitable engineering materials for mechanical components/products, and select appropriate characterization techniques for property evaluation.			x	
3	Understand the primary classes of materials used in the various industries including the aerospace sector, and how they behave in relation to their mechanical properties including fatigue and fracture.			x	
4	Describe main manufacturing processes by which materials can be processed to create engineering products and select the most appropriate manufacturing technologies for cost-effective product production.			x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	This includes a combination of lectures and tutorial classes on typical engineering materials (basics and mechanical behaviours), materials for different industries, and corresponding manufacturing processes.	1, 2, 3, 4	3 hrs/week for 12 weeks
2	Laboratory Work	This includes practical classes to understand the basic structure of engineering materials, to study the behaviour, and to observe a range of manufacturing processes. These will be reported in the form of short and concise technical reports.	1, 2, 3, 4	3 hrs/week for 3 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Test	1, 2, 3, 4	25	
2	Laboratory Reports	1, 2, 3, 4	15	3 reports

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2.5

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Mid-term Test

Criterion

1.1 Capability to describe the basic structure and behaviour of commonly used engineering materials, and to select the appropriate materials for components or products for structural applications.
1.2 Capability to outline the basic microstructure features and associated mechanical properties of some important engineering materials.

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2.Laboratory Reports

Criterion
2.1 Evidence of understanding the basic structure and behaviour of common engineering materials and some typical materials and associated manufacturing for the industry.
2.2 Evidence of self-learning, information searching and technical writing.
2.3 Ability to appreciate the features and working principles of various materials characterization techniques.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Examination

Criterion
3.1 Ability to describe the primary classes of materials used in various industries including the aerospace sector.
3.2 Ability to examine the mechanical behaviour/performance of typical materials used in aerospace industries by describing and selecting appropriate characterization techniques.
3.3 Ability to select appropriate manufacturing technologies for cost-effective product production.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Additional Information for AR
Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

- Structure and Properties of Metallic and Non-metallic Materials: Structure of metals, ceramics and polymers, composite materials, atomic structure and bonding, crystalline structure, defects, diffusion, materials selection, phase diagrams.
- Mechanical Behaviour of Engineering Materials: Elastic property, plastic property, stress-strain curves, dislocation, ductility, failure, strengthening, an introduction to fracture mechanics, fatigue and creep.
- Materials Characterization and Selection: Mechanical testing, microstructure characterization, microstructure-property relationship, materials selection.
- Composite materials: Metal-matrix composite, polymer-matric composite, carbon fibre composite manufacturing, polymer processing and injection moulding, additive manufacturing, ceramic processing, casting and extrusion, joining processes.

Reading List

Compulsory Readings

	Title
1	“Materials Science and Engineering: An Introduction”, William D. Callister, Jr. and David G. Rethwisch, 10th edition, 2018, John Wiley & Sons, Inc.
2	“Manufacturing Technology for Aerospace Structural Materials” Campbell F.C., Elsevier Science 2006.

Additional Readings

	Title
1	“Materials Science and Engineering Properties”, Charles M. Gilmore, Cengage Learning, 1st edition, 2014.
2	“Essentials of Advanced Composite Fabrication & Repair”, 2nd edition, Dorworth, Gardiner, Mellema, 2019, Aviation Supplies & Academics, Inc.
3	“Composite Materials Science and Engineering”, 4th edition, Chawla K.K., 2019, Springer.
4	“Introduction to Aerospace Materials”, Adrian P Mouritz, 2012, Elsevier.